REMARKS

The Office Action mailed July 7, 2003 has been received and reviewed. Claims 1, 13, 27, and 35 have been amended. No claims have been cancelled. Therefore, claims 1-44 are pending in the present application. Reconsideration and withdrawal of the rejections are respectfully requested.

Claim Amendments

The claims were amended to make it clear that an ellipsometric apparatus is being described therein and that the analyzer is used for resolving the state of polarization of the reflected light which is necessary to the functionality of an ellipsometry apparatus and for which support can be found throughout the specification of the pending application.

The amendments made to the claims are only intended to clarify the claims, however, the scope of the amended claims are intended to be the same after the amendments as it was before the amendments.

The 35 U.S.C. §102 Rejection

The Examiner rejected claims 1, 4, 9-11, 13, 16, 21-22, 24-25, 27, 29, 33-35, 37, and 42-43 under 35 U.S.C. §102(e) as being anticipated by Kuhn (U.S Patent No. 6,404,544). Applicants traverse such rejections.

Claims 1, 13, 27, and 35

In regards to independent claims 1, 13, 27, and 35, the Examiner alleges that Kuhn teaches all the elements of such claims. For a claim to be rejected under 35 U.S.C. §102(e), each and every element of the claim must be found in the cited prior art reference.

Applicants submit that independent claim 1 is not anticipated by Kuhn for at least the following reasons. Applicants submit that Kuhn does not describe an ellipsometer that includes, for example, an analyzer portion for use in resolving the polarization state of the reflected light, nor an analyzer portion operable to generate polarization information based on the reflected light

such as performed in ellipsometry (e.g., wherein the polarization information is a function of the p and s wave components of the incident light having different reflectivities from the sample and representative of the state of polarization of the reflected light).

As set forth in previous responses to Office Actions, ellipsometry is based on the use and measurement of polarized light. The name ellipsometry is derived from the fact that measurement of elliptically polarized light is a basis of ellipsometry. Elliptically polarized light is formed due to the simultaneous existence of the p and s wave components and the differences in reflectivity for the p and s wave components from the sample. The p and s wave components interact to provide ellipsometric information about the sample. The ellipsometer measures or resolves the state of polarization of the reflected light.

Fundamental quantities of ellipsometry include the Psi, Delta (Ψ, Δ) pair. Such quantities can be defined in terms of the reflectivities of the p wave and s wave components, as described in the background section of the present application. In the context of ellipsometry, a p wave refers to a component of light in which the electric field is parallel to the plane of incidence of the sample to be measured and an s wave refers to a component of light in which the electric field is perpendicular to the plane of incidence of the sample to be measured. Fundamental to ellipsometry is the usage of incident light which includes both a p wave component and an s wave component, and reflected light which includes both a p wave component and s wave component. This can be shown by considering, for example, the definition of a fundamental quantity of ellipsometry, Δ. The value of Δ is defined as $\delta_1 - \delta_2$, where δ_1 is defined as the phase difference between the p wave and s wave before the reflection, and δ_2 is defined as the phase difference between the p wave and s wave after the reflection.

The present invention as described in claim 1, provides: an illumination source providing incident linearly polarized light such that the linearly polarized light includes p and s wave components; reflected light from the sample such that the reflected light includes p and s wave components; and an analyzer portion for use in resolving the polarization state of the reflected light, wherein the analyzer portion is operable to generate polarization information based on the reflected light such as performed in ellipsometry, wherein the polarization information is a

function of the p and s wave components of the incident light having different reflectivities from the sample.

In contrast to ellipsometry, Kuhn describes an interferometric device referred to as a differential interference contrast microscope. In other words, Kuhn is concerned with "Differential Interference Microscopy". Although this type of microscopy may not be completely understood from the patent reference Kuhn, the following is provided as a background for such a technique in order to understand the differences between the claimed ellipsometer and the Kuhn device.

In a typical differential interference contrast configuration, specimens are sampled by two closely spaced partially coherent, but orthogonal, wavefronts separated by a distance. The wave pairs employed in differential interference contrast are typically generated by the action of a birefringent beamsplitter (e.g., either a Wollaston or Nomarski compound prism such as the DIC prism described in Kuhn) on a plane-polarized wavefront of light originating from a source and focused into the front focal plane of the microscope condenser (where the beamsplitter is positioned).

When a pair of mutually coherent light rays produced by the beamsplitter (e.g., the DIC prism of Kuhn) encounters a phase gradient, due to refractive index and/or thickness variations, each ray will become deformed and experience a slightly different optical path difference when traversing through the specimen. Upon emerging from the specimen, the rays will be unequal in phase. The difference in optical path is translated by the microscope into a change in amplitude in the final image observed.

The interferometer (i.e., the differential interference contrast microscope described in Kuhn) does not operate like the ellipsometer described in claim 1. Whether considering the operation of the apparatus shown in Figure 1 or Figure 4 of Kuhn, Kuhn still functions as a type of interferometer. Thus, Kuhn only measures the intensity of the resulting interference and does not determine the complete state of polarization of the reflected light. Kuhn uses two wavelengths (e.g., channels) multiplexed to obtain data in two directions. As shown in Figure 4, Kuhn uses a four quadrant prism 146 and a wavelength selecting filter 124 placed over the

quadrants of the prism to provide the two different wavelengths in the system. Kuhn's filter has to be transmissive to some wavelength in all quadrants. For example, it could be designed to be transmissive at wavelength 1 in the first and third quadrants, and wavelength 2 in the second and fourth quadrants. However, a filter that is totally blocking to all light in two of the four quadrants (such as the filter described in the present application which breaks the azimuth symmetry of the incident or reflected light) would not produce the two channels that the Kuhn apparatus requires for operation.

In other words, in Kuhn, the incident light (e.g., that includes two different states of polarization) is provided for impingement on a sample. However, the reflected light is sheared before the components of reflected light are interfered (hence the name differential interference) (i.e., in the present invention, no shearing takes place). After the interference takes place, the light is simply passed through a linear polarizer and detected. In column 6, lines 25-29, Kuhn states that "[t]he analyzer 48 comprises a fixed polarizer at 45 degrees to the shear direction of the prism 46 to take approximately equal amounts of light from the two output polarizations produced by the DIC prism."

Unlike the presently claimed ellipsometric invention, although two different polarization states may be used in the incident light, the usage is totally different than in ellipsometry, as are the detection techniques used. Differential interference contrast microscopy simply uses the two different polarization states to multiplex the two arms of an interferometer along a common path. At the end of the interferometer (right before the detector), the 45 degree polarizer cause the s and p states to interfere. The two polarization states are sheared with respect to each other, and detection only measures the intensity of the interferences, <u>without regard to the state of polarization</u>. In other words, the actions described in Kuhn are not enough to completely resolve the state of polarization of the reflected light as is the case in ellipsometry which is claimed in the present application (e.g., further clarity with respect to the fact that the present claimed methods and apparatus are ellipsometric in nature and not interferometers has been provided again with the amendments provided herein). A simple measurement of intensity as described in Kuhn cannot recover the state of polarization of the reflected light. For example, one must vary

two different parameters in an ellipsometric apparatus to make such a measurement, e.g., analyzer angle and quarter-wave plate angle.

As such, and because Kuhn does not describe an ellipsometer apparatus as described in the present application, claim 1 is not anticipated thereby.

Applicants submit that independent claims 13, 27, and 35 are not anticipated by Kuhn for at least the same reasons as given above with respect to claim 1.

Furthermore, in regards to claim 27, Applicants submit that Kuhn does not describe a spatial filter, wherein the spatial filter is used to break the azimuth symmetry of the incident or reflected light. Kuhn describes a wavelength selecting filter that is used to multiplex the shear direction by wavelength in the interferometer system. In other words, Kuhn generates two independent signals.

In the present invention, the pupil filter is used to break the symmetry of the ellipsometric signal to extract information (page 13, lines 3-7 of the specification). Only a single signal is generated. The ellipsometric signal comes from the interference between the p and s wave components. Kuhn never measures the complete state of polarization of the final signal, and therefore, does not need to break the symmetry of the ellipsometric signal. In other words, Kuhn does not provide a spatial filter used to break the symmetry of the ellipsometric signal because Kuhn does not even provide an ellipsometric signal.

Furthermore, with respect to claim 35, Applicants submit that Kuhn does not describe a spatial filter wherein the spatial filter is used to break the azimuth symmetry of the incident or reflected light, for the same reasons as described above reference to claim 27.

For at least the reasons given above, Kuhn does not anticipate claims 1, 13, 27, and 35.

Claims 4, 9-11,16, 21-22, 24-25,29, 33-34, 37, and 42-43

In regard to dependent claims 4, 9-11,16, 21-22, 24-25,29, 33-34, 37, and 42-43 which depend directly or indirectly from independent claims 1, 13, 27, and 35, such claims are not anticipated by Kuhn for the same reasons as stated above for claims 1, 13, 27, and 35, and by reason of their own limitations.

<u>The 35 U.S.C. §103 Rejection</u>

The Examiner rejected claims 2-3, 5-8, 12, 14-15, 17-20, 23, 26, 28, 30-32, 36, 38-41 and 44 under 35 U.S.C. §103(a) as being unpatentable over Kuhn (U.S. Patent No. 6,404,544) in view of Ghislain et al (U.S. Patent No. 5,939,709). Applicants traverse this rejection.

<u>Claims 2-3, 5-8, 12, 14-15, 17-20, 23, 26, 28, 30-32, 36, 38-41 and 44</u>

In regard to dependent claims 2-3, 5-8, 12, 14-15, 17-20, 23, 26, 28, 30-32, 36, 38-41 and 44 which depend directly or indirectly from independent claims 1, 13, 27, and 35, such claims are not obvious over Kuhn in view of Ghislain et al. in that they depend from independent claims 1, 13, 27, and 35 which applicants submit are lacking elements that are not described, taught, or suggested by Kuhn. Ghislain et al. does not provide such missing elements nor is their any motivation to combine the references or modify Kuhn with Ghislain et al. to obtain the ellipsometer apparatus and methods described in the rejected claims.

Summary

It is respectfully submitted that the pending claims are in condition for allowance and notification to that effect is respectfully requested. The Examiner is invited to contact Applicants' Representatives, at the below-listed telephone number, if it is believed that prosecution of this application may be assisted thereby.

Respectfully submitted for
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CERTIFICATE UNDER 37 CFR §1.10:
"Express Mail" mailing label number: EV 073687214 US Date of Deposit: November 7, 2003
The undersigned hereby certifies that the Transmittal Letter and the paper(s) and/or fee(s), as described hereinabove, are being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR §1.10 on the date indicated above and is addressed to the Assistant Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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